# Racial/ethnic variation in United States prediabetes prevalence estimates under alternative 2010 American Diabetes Association criteria: 1988–2008

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## Abstract

**Objective—**Compare racial/ethnic variation in United States prediabetes prevalence estimates for alternative prediabetes definitions currently approved by the American Diabetes Association (ADA) across 20 years and in detailed multivariate comparisons.

**Design—**Using nationally representative National Health and Nutrition Examination Survey (NHANES) data from 1988–2008, we compared trends in the prevalence of impaired fasting glucose (IFG) and impaired glycated hemoglobin (IGH) for non-Hispanic Black, non-Hispanic White, and Mexican American/other Hispanic adults. Using NHANES 2005–2008, we compared prevalence by race/ethnicity in more detail for the three current ADA prediabetes definitions — IFG, IGH, and impaired glucose tolerance (IGT) — controlling for associated factors (education, income, weight, age, gender).

**Results—**Prediabetes prevalence over the last 20 years was consistently significantly lower among non-Hispanic Blacks compared to non-Hispanic Whites when measured by IFG, but was significantly higher among non-Hispanic Blacks for IGH. In adjusted models, non-Hispanic Blacks were significantly more likely than non-Hispanic Whites to have IGH (OR: 2.22; 95% CI: 1.33–3.70) and less likely to have IFG (OR: 0.46; 0.30–0.73) or IGT (OR: 0.35; 0.24–0.50), but Mexican American/other Hispanic rates did not differ significantly from non-Hispanic White rates. However, rates of prediabetes, when defined by *any* of three individual diagnostic criteria, were not statistically significantly different across groups (36.8% for non-Hispanic Whites, 36.0% AA, 37.3% Mexican American/other Hispanics).

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**Conclusions—**National prediabetes prevalence estimates vary dramatically across racial/ethnic groups according to diagnostic method, though over 35% in all three racial/ethnic groups met at least one ADA diagnostic criteria for prediabetes.

### Keywords

Prediabetes; Minority Groups; Minority Health; Health Status Disparities

Disparities in diabetes prevalence and related complications by race/ethnicity are well established.[1,2] Rates of diabetes are 70–80% higher among Non-Hispanic Blacks and Mexican Americans compared to non-Hispanic Whites.[3] Blacks and Hispanics also have higher age-adjusted mortality rates for diabetes compared to Whites and carry a greater burden from many, but not all, complications.[1,2,4]

Racial/ethnic disparities in prevalence have not been observed in population-based measures of "prediabetes," a state of elevated blood glucose too high to be considered normal, yet too low for a diabetes diagnosis.[3] Prediabetes is associated with both an increased risk of subsequent diabetes as well as cardiovascular events.[5,6] Considering the higher rates of diabetes seen in Blacks and Hispanics compared to Whites, it is notable that similar disparities have not been reported for prediabetes.[3]

One area that can provide insight into patterns of racial/ethnic disparities in abnormal glucose is variation in prediabetes estimates by diagnostic criteria and method. Until 2010, the presence of prediabetes was ascertained using two glucose-based diagnostic criteria: impaired fasting glucose (IFG) and/or impaired glucose tolerance (IGT).[7] Using these criteria, similar rates of prediabetes among Whites, Blacks, and Mexican Americans were observed even in age- and weight- adjusted models.[3]

In 2010, the ADA introduced a new diagnostic criterion for prediabetes termed "high risk" of progression to diabetes. Also known as impaired glycated hemoglobin (IGH), this was measured by lab-based hemoglobin A1c (A1c) values rather than glucose.[7] The change was made based on clinical and practical advantages of using A1c to identify abnormal glucose states.[7]

The new criterion has implications for the surveillance of population-based trends in abnormal glucose in general and for measuring racial/ethnic disparities in abnormal glucose specifically.[8,9,10] Studies that have quantified variation in diabetes and prediabetes classification under the new ADA A1c criteria[8,9] or the similar International Expert Committee A1c criterion[10] compared to previous glucose-based standards have found substantial racial/ethnic differences in diabetes and prediabetes rates under different criteria. Of particular relevance, Blacks are more likely to be classified as having diabetes or prediabetes under the new A1c criterion, and Whites and Hispanics much less likely to be classified as such.[9,10]

Missing from the existing literature is a detailed understanding of how different prediabetes diagnostic criteria quantify racial/ethnic disparities in diabetes risk on a population-level across time and also while controlling for other socio-demographic variables. To our

knowledge, no study has used the complete set of possible 2010 ADA prediabetes definitions to compare prevalence estimates by race/ethnicity across 20 years of the U.S. population-based data. Nor has a study considered whether socio-demographic factors decrease racial/ethnic differences in prediabetes prevalence estimates using detailed multivariate comparisons. This study sought to fill these research gaps.

## Methods

### NHANES

The National Health and Nutrition Examination Survey (NHANES) are nationally representative surveys administrated by the National Center for Health Statistics since 1988.[11] NHANES data are a primary data source for U.S. diabetes-related prevalence estimates and trends.[3] Due to variation in laboratory tests for types of prediabetes across surveys,[11] our study has two parts: (1) a trend analysis using NHANES 1988–2008 comparing historical trends in IFG and IGH prevalence by race/ethnicity, and (2) a detailed analysis using NHANES 2005–2008 comparing IFG, IGT, and IGH by race/ethnicity considering sociodemographic factors.

### Study Samples

To be included in the trend analysis, individuals in six samples of NHANES (1988–2008) had to be 20 years of age and to have had a morning fasting plasma glucose test (FPG) with valid fasting hours and valid test results. Only certain sub-samples of the larger NHANES samples were given the FPG test and specific subsample varied by cohort. Details of the lab tests and exclusion criteria for each year can be found at http://www.cdc.gov/nchs/nhanes.htm. All of these participants had valid A1c scores. Sample sizes by NHANES years for the trend analyses were 9,614 (1988–1994); 1,845 (1999–2000); 2,198 (2001–2002); 1,964 (2003–2004); 1,677 (2005–2006); and 2,119 (2007–2008).

In the detailed analysis, we used two recent NHANES samples (2005–2006 and 2007–2008) to examine racial/ethnic prediabetes rates across alternative definitions in more detail. We combined 1,887 NHANES respondents from 2005–2006 and 2,227 respondents from 2007–2008 NHANES aged 18 years who took both an FPG and an Oral Glucose Tolerance Test (OGTT). All of these participants had valid A1c scores. The combined study sample for the detailed analysis was 4,114.

### Lab values

The NHANES equipment and laboratory measuring glucose and A1c changed over time. Conversion factors were applied to lab values from 2005–2008 to make them comparable with values from NHANES 1988–2004. Detailed information about conversion methods is available at http://www.cdc.gov/nchs/nhanes.htm. Our analyses accounted for recent NHANES technical updates concerning NHANES 2005–2006 and 2003–2004 A1c comparisons (http://www.cdc.gov/nchs/data/nhanes/A1c_webnotice.pdf).

## Variables

**Prediabetes—**In the trend analyses, prediabetes was defined by the three ADA 2010 definitions that could be tested in all six NHANES subsamples. Specifically, among individuals who did not self-report diabetes, prediabetes was defined as having: (1) IFG, indicated by an FPG level from 100–125 mg/dl; (2) IGH, indicated by having an A1c 5.7% and < 6.5%; or (3) having either IFG or IGH.

In the detailed analysis, OGTT results were also available allowing for the inclusion of prediabetes as defined by IGT of 140 mg/dl to 199 mg/dl measured by a two-hour OGTT[7] if diabetes was not self-reported. To fully consider prediabetes prevalence variation by race/ethnicity across different diagnostic criteria, the 2010 ADA prediabetes criteria were used to create six possible definitions. Prediabetes could be defined as: (1) any prediabetes (meeting a definition of IFG, IGH, or IGT), (2) IFG, (3) IGT, (4) IFG and/or IGT (the traditional "prediabetes" definition), (5) IGH, and (6) prediabetes only under IGH. Individuals in options 2–5 could have prediabetes by another diagnostic criterion if they met the prediabetes criterion for that option. Individuals in option 6 were only included if they did not meet diagnostic criteria for IFG or IGT. This final group would only have been classified as "at risk" using the new A1c diagnostic criterion.

**Race/Ethnicity—**In the trend analyses, three categories of self-reported race/ethnicity were included: non-Hispanic White, non-Hispanic Black, and combined Mexican American/other Hispanic groups. (In the NHANES 1988–1994, no other Hispanic category was included besides Mexican American, so for this cohort the Mexican American/other Hispanic category includes only Mexican Americans.) In the detailed analysis, four categories were considered: non-Hispanic White, non-Hispanic Black, Mexican American/other Hispanic, and Other race.

**Other Study Variables—**Self-reported diabetes was based on an individual reporting that a doctor or health professional had told them they had diabetes. Undiagnosed diabetes was based on 2010 ADA criteria. In the trend analysis, among adults not self-reporting diabetes, undiagnosed diabetes was defined for each of the three prediabetes definitions as follows. For IFG, undiagnosed diabetes was indicated when FPG 126 mg/dl. For IGH, undiagnosed diabetes was indicated when A1c 6.5%. For IFG/IGH, undiagnosed diabetes was indicated when FPG 126 mg/dl or A1C>=6.5%. Normal glycemia was also defined individually for each of the three definitions among adults not self-reporting diabetes as follows. For IFG, normal glycemia was indicated when FPG<100 mg/dl. For IGH, normal glycemia was indicated when A1C<5.7%. For IFG/IGH, normal glycemia was indicated when FPG<100 mg/dl and A1C<5.7%. In the detailed analyses, self-reported and undiagnosed diabetes under any ADA 2010 criteria were excluded from all prediabetes classifications.

In multivariate models of the detailed analyses, controls were age (18–44, 45–64, and 65+ years), gender (male/female), weight groups (normal BMI<25, overweight BMI 25 and <30, and obese if BMI 30), educational attainment in three categories (less than high school graduate, high school graduate, some college or higher) and household income in two levels (<$20,000/year and $20,000/year).

### Analyses

Descriptive analyses examined trends in prediabetes prevalence for the three racial/ethnic groups for IFG, IGH, and IFG and/or IGH. Trends were compared with chi-square tests of the first study period (1988–1994) and the final study period (2007–2008) across race/ethnic groups. Chi-square tests were also performed comparing prevalence differences across racial/ethnic groups for each prediabetes definition within each NHANES sample.

In the detailed analysis, chi-square tests considered variation across racial/ethnic groups in rate estimates for all six possible prediabetes definitions. Multivariate logistic regression analyses were used to predict overall prediabetes prevalence by race/ethnicity for each definition with other factors controlled.

All statistical analyses were performed with SAS 9.1 (SAS, SAS Institute, Gary, NC) and took into account the complex survey design and population-level weights for combined samples using SAS proc surveymeans and proc surveylogistic commands.

## Results

### Trend Analysis: NHANES 1988–2008

Racial/ethnic trends in prediabetes estimates over the past 20 years across varying definitions are shown in Figures 1–3. As can be seen in Figure 1, non-Hispanic Blacks had lower IFG prevalence than non-Hispanic Whites and Mexican American/other Hispanics (except in 2003–2004), and were the only racial/ethnic group without a visible upward trend of prediabetes prevalence over time. When IGH was used (as can be seen in Figure 2), the relative prevalence rates reversed, and non-Hispanic Blacks had consistently higher prediabetes prevalence rates than non-Hispanic Whites or Mexican American/other Hispanics. As demonstrated in Figure 3, when either IFG or IGH was used to define prediabetes, prevalence rates by race/ethnicity were higher overall and did not show one racial/ethnic group as consistently higher or lower than others.

Within individual NHANES samples, significant differences (chi-square p-values <.05) in IFG prevalence by race/ethnicity were seen for four out of six samples (1988–1994, 2001–2002, 2003–2004, 2007–2008) and for IGH prevalence in five out of six samples (1988–1994, 2001–2002, 2003–2004, 2005–2006, 2007–2008). Significant differences across racial/ethnic groups were seen for combined prediabetes (IFG/IGH) only in the 1988–1994 sample. There was a significant increase in both IFG and IGH prevalence during the past 20 years overall for all groups combined (chi-square p-values < 0.001), but in individual analyses by racial/ethnic groups, this trend was only significant for both IFG and IGH among the non-Hispanic White group.

### Detailed Analysis: NHANES 2005–2008

Table 1 presents the racial/ethnic variations in prevalence estimates across the 6 prediabetes definitions by race/ethnicity. As in the combined IFG/IGH rates in the trend analysis, rates of "any" prediabetes did not vary statistically across racial/ethnic groups (36.8% for non-

Hispanic Whites, 36.0% for non-Hispanic Blacks, and 37.3% for Mexican American/other Hispanics).

However, within definitions, prediabetes rates varied considerably by race/ethnicity. Table 1 shows that non-Hispanic Blacks had the highest rates of prediabetes under IGH, at 29.8%, compared to 17.7% for non-Hispanic Whites and 17.0% for Mexican American/other Hispanics. The opposite was seen for IGT and IFG, where non-Hispanic Whites and Mexican American/other Hispanics had higher rates than non-Hispanic Blacks. The "IGH only" category, indicating the percentage of individuals who would only have been categorized as "at risk" using the new A1c diagnostic criterion, ranged from 7.2% in Mexican American/other Hispanics to 8.7% in non-Hispanic Whites to 18.8% in non-Hispanic Blacks. Chi-square comparisons of prevalence rates for prediabetes by race/ethnicity for all of the six possible definitions indicated significant variation at p<0.01 except for "any prediabetes," which did not vary significantly by race.

Multivariate models were then estimated for each definition of prediabetes by race/ethnicity. Table 2 shows the odds ratios from multivariate logistic models predicting prediabetes by race/ethnicity under each prediabetes classification from NHANES 2005–2008 controlling for age, gender, weight, education, and household income. In these models, Non-Hispanic Blacks were significantly more likely to meet prediabetes criteria for IGH (OR: 2.22; 95% CI: 1.33–3.70), and significantly less likely for IFG (OR: 0.46; 95% CI: 0.29–0.73) and IGT (OR: 0.35; 95% CI: 0.24–0.50). Non-Hispanic Blacks were also significantly more likely than non-Hispanic Whites to meet the IGH-only prediabetes criterion in adjusted models (OR: 3.47; 95%CI: 1.95–6.16). Mexican American/other Hispanics did not vary significantly from non-Hispanic Whites in any of the multivariate models. In the fully adjusted model predicting "any prediabetes," rates did not vary significantly by race/ethnicity.

## Conclusions

Previous research has suggested that prediabetes prevalence rates by race/ethnicity might appear very different using the new diagnostic criterion for prediabetes.[9,10] Our study confirms and extends these findings revealing that our understanding of racial/ethnic disparities in prediabetes prevalence at the national level varies considerably by the criterion chosen. Our study distinguishes itself from previous work by including a longer time horizon, more 2010 ADA prediabetes diagnostic criteria alternatives, and including demographic control variables.

Traditional measures of prediabetes (IGT and/or IFG) find that more non-Hispanic Whites and Mexican American/other Hispanics are classified as having prediabetes than non-Hispanic Blacks, while the new A1c criterion suggests that more non-Hispanic Blacks are classified as having prediabetes. These racial/ethnic differences across criteria were observed even when additional controls (education, household income) were added to the previously studied variables of weight, age, and gender,[10] suggesting that sociodemographic variables included in this study do not explain the racial/ethnic differences seen between prediabetes classification criteria.

Our study provides insight into a seemingly contradictory finding of previous research: the fact that non-Hispanic Blacks have significantly higher prevalence of diabetes than non-Hispanic Whites, but no difference in prediabetes prevalence. We find that non-Hispanic Blacks only have lower or similar prediabetes prevalence compared to non-Hispanic Whites under glucose-based definitions of prediabetes, but not under the new A1c criterion. In fact, 18.9% of non-Hispanic Blacks had prediabetes under the IGH-only criteria in our detailed analysis, meaning they would only have been categorized "at risk" using the new A1c diagnostic criteria. This is consistent with other findings suggesting that Blacks have higher levels of A1c than Whites across glucose categories.[12]

This difference in prediabetes prevalence was not seen because non-Hispanic Blacks were more likely to have undiagnosed diabetes under fasting glucose tests, or because non-Hispanic Whites and Mexican American/other Hispanics had more undiagnosed diabetes under the A1c criterion. The difference resulted from those who were classified as normal under other criteria. These results are available on request.

Tradeoffs between who was identified as "at risk" by race/ethnicity were seen amongst the different definitions, all currently in use in research, surveillance, and clinical practice. For example, as seen in Table 1, total prediabetes for non-Hispanic Blacks using any definition was 36.0%. Using FPG alone (the testing strategy most commonly used in practice[13]) will only detect about half of the total prediabetes cases among non-Hispanic Blacks (IFG rate is 18%). On the other hand, A1c testing in non-Hispanic Blacks would capture about 83% of all prediabetes cases (A1c rate is 29.8%). But using the A1c testing method will classify only a quarter of non-Hispanic Whites and less than 20% of Mexican American/other Hispanics with 'any prediabetes' at risk.

These observations bring up questions of sensitivity and specificity in prediabetes testing, as well as issues of inter-test agreement. There is a clear lack of concordance between testing methods in who is designated "at risk" by racial/ethnic group, but standard methods to calculate sensitivity and specificity necessitate a gold standard. While OGTT has been a widely acknowledged diagnostic standard,[9,14] both the ADA and IEC have discussed the limitations of OGTT, as well as the variation between OGTT and FPG in estimating prevalence of abnormal glucose and in links to clinical outcomes. An argument has been made that A1c may be a better indicator of abnormal glucose levels, in part due to the strong relationship to long-term complications, particularly diabetic retinopathy.[15]

Our findings have relevance to this debate. We highlight that the greater catchment of non-Hispanic Whites, Mexican American/other Hispanics, and the overall population with prediabetes using OGTT comes with a tradeoff for non-Hispanic Blacks, a group known to have a high risk for diabetes and its complications. It is not clear from the current state of the science whether non-Hispanic Black individuals who test positive for IGH and negative for IGT or IFG should be considered "false positives," or simply a distinct group at risk. However, if Black individuals in a clinical setting are not identified as at risk for diabetes and thus not provided with intervention, this could increase racial/ethnic diabetes-related disparities. Similarly, if large percentages of Black populations are not identified as "at risk"

for diabetes within public health surveillance, important opportunities for diabetes-related planning and interventions may be missed.

Using the "any prediabetes" criterion led to a much higher prediabetes prevalence estimate overall, and over time, for all racial/ethnic groups than previously reported.[3] This increase is especially significant in the non-Hispanic Black population, which changed in the two recent NHANES from 21.8% defined as having prediabetes using only IGT and/or IFG definitions to 36.0% using the comprehensive definition. This newly identified at-risk population represents a substantial number of US adults. Whether or not to identify all these individuals "at risk" may depend on program goals: public health surveillance, screening, diagnosis, or intervention.

The full public health implications of these differences are not known in part because the relationship of impaired glucose metabolism and A1c to diabetes risk and outcomes by race/ethnicity is not fully established, nor are the clinical implications for the differing correlations between A1c and serum glucose levels observed between Blacks and Whites.[12] Further research into the specifics of individuals captured under various definitions can help identify the strengths and weaknesses of the various diagnostic criteria in delineating diabetes risk[16,17] and in identifying individuals who can benefit from intervention,[18] especially as these trajectories may vary significantly by race/ethnicity.[12]

Our trend analysis highlights that this variation impacts our understanding of prevalence rates and health risks by racial/ethnic groups across time as well. While rates of prediabetes (using any definition) have increased over the last 20 years among all groups and Whites, whether we conclude that this is also true for Mexican Americans/other Hispanics depends on the definition. Prediabetes rates for Mexican American/other Hispanics increased only under the IFG definition or the combined IFG/IGH definition, but not under IGH. For non-Hispanic Blacks, because of high rates of IGH in the 1998–1994 NHANES, and stable rates of IFG across all samples, no significant increase in prediabetes prevalence was seen over the 20-year NHANES time span using any prediabetes definition despite large diabetes increases in this population.

## Limitations

While the analyses we carried out used data collected over 20 years, this is not a longitudinal study and trends do not represent individuals' lab values across time. Also, laboratory testing methods for FPG, OGTT, and A1c were not consistent across different NHANES surveys. While we followed recommended procedures to make lab testing comparable across surveys, measurement differences may still exist.

This study does not explain why Mexican American/other Hispanics prediabetes rates do not differ significantly from Whites across definitions, or why the rates of prediabetes under the "any prediabetes" criterion were the same across racial/ethnic groups. Considering the greater burden of diabetes and diabetes complications in Blacks and Hispanics, exploring whether these similar total prediabetes prevalence rates mask different diabetes risk by race/ethnicity remains of interest. The combined Mexican American/other Hispanic categories

from the NHANES samples used in this study do not provide representative estimates of all US Hispanics; however, more recent NHANES samples can provide this data and may be a useful source for further research on this topic.[19] Further research should also follow individuals identified through any of these diagnostic categories to measure their relative likelihoods of developing diabetes or other negative health outcomes and explore differences in these relationships with modifiable risk factors. This may illuminate which test, or combination of tests, should be used for surveillance, screening and intervention generally and, if necessary, for individual racial/ethnic groups. We also lacked the granular race/ethnicity detail to consider Asians, Pacific Islanders, and other racial/ethnic groups with important diabetes disparities[20] who should be included in further research.

Whether termed "prediabetes" or "high risk for diabetes," the state of abnormal glucose regulation below whichever diabetes cutoff is employed is important for clinical identification, risk recognition, and targeted lifestyle intervention.[5] While diabetes impacts approximately 12% of the adult population, prediabetes is seen in a much larger proportion of US adults— almost 30% in a recent estimation using the IFG and/or IGT criteria[3] and almost 40% in our study using any 2010 ADA prediabetes criterion. This detailed, comprehensive look at racial/ethnic variation within definitions across time and population groups reveals how fundamentally our understanding of prediabetes disparities varies by diagnostic criteria, and should be considered in policy, research, and clinical practice.

## Acknowledgments

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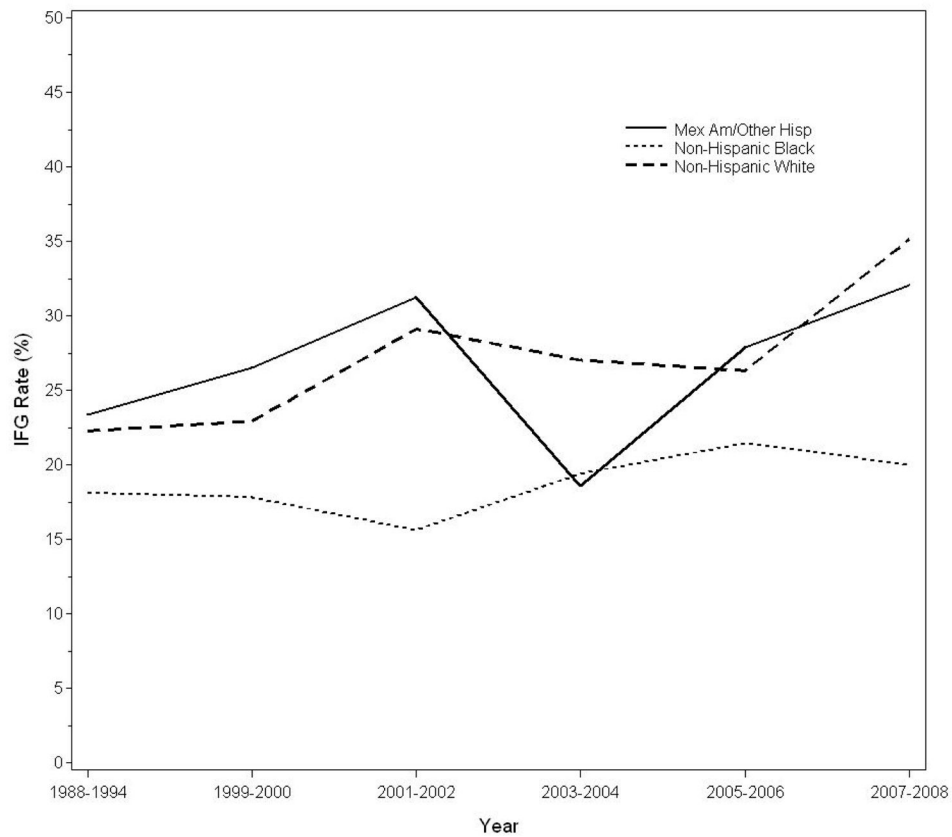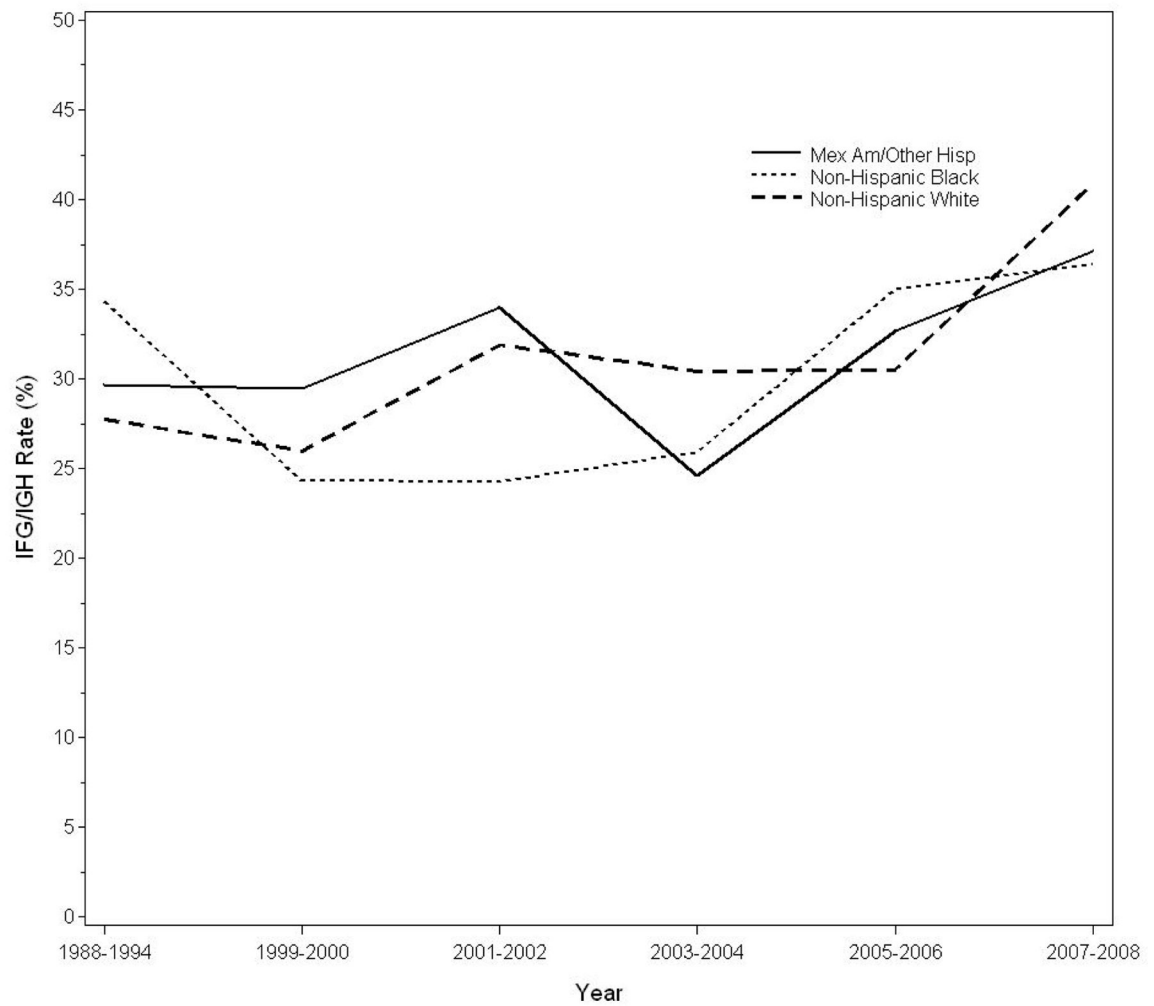
**Figure 1.**
Prevalence of Impaired Fasting Glucose (IFG) by Race/Ethnicity from NHANES 1998–2008.[1]

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[1]In the NHANES III (1988–1994), no other Hispanic category was included besides Mexican American, so for these years the Mexican American/other Hispanic category includes only Mexican Americans.
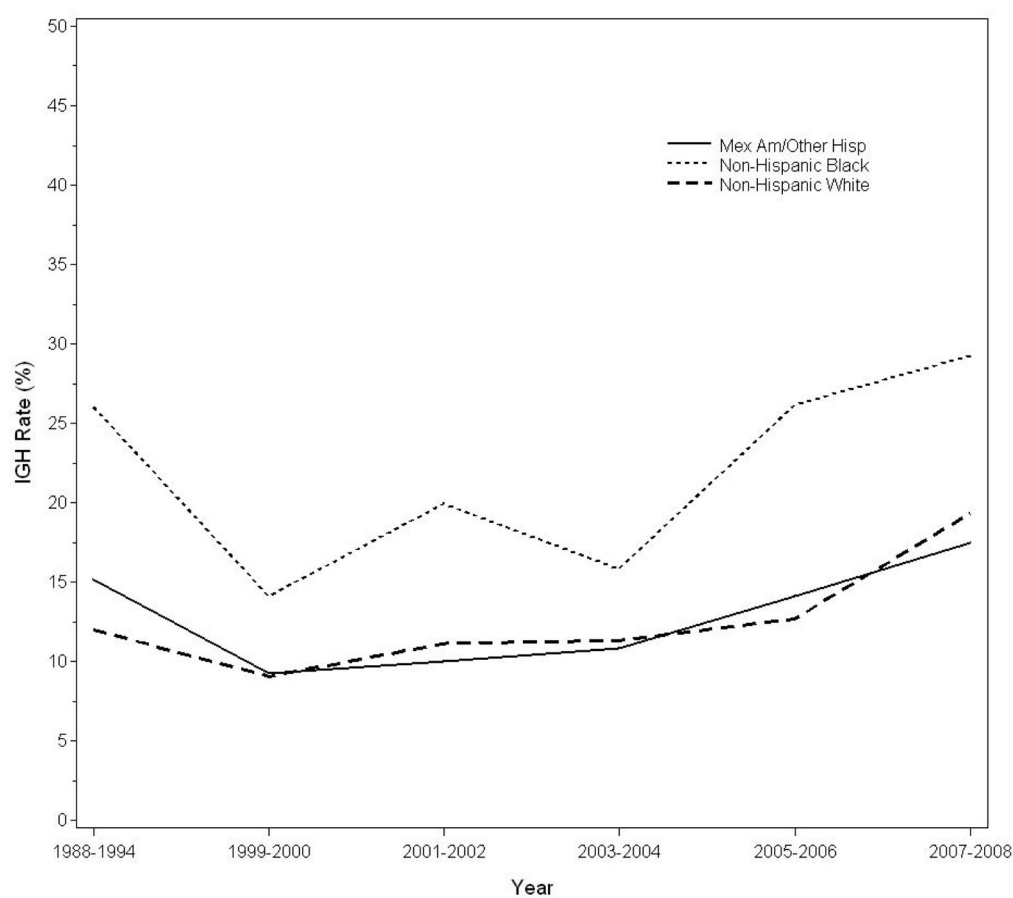
**Figure 2.**
Prevalence of Impaired Glycated Hemoglobin (IGH) by Race/Ethnicity from NHANES 1998–2008[1]

**Figure 3.**
Prevalence of Impaired Fasting Glucose and/or Impaired Glycated Hemoglobin by Race/
Ethnicity from NHANES 1998–2008[1]

**Table 1**

Unadjusted percentage of persons classified as "prediabetes" by race/ethnicity for each method of diagnosis in NHANES 2005–2008 (unweighted N = 4114)

| | All | | | Non-Hispanic White | | | Non-Hispanic Black | | | Mexican American/Other Hispanic | | | Chi-sq |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | UnW n* | %† | SE | UnW n | % | SE | UnW n | % | SE | UnW n | % | SE | p-value |
| Any Prediabetes‡ | 1560 | 36.7% | 0.9% | 788 | 36.8% | 1.4% | 295 | 36.0% | 1.8% | 413 | 37.3% | 2.0% | 0.9883 |
| IFG | 1064 | 26.2% | 1.0% | 578 | 27.2% | 1.3% | 148 | 18.0% | 1.5% | 286 | 26.9% | 1.8% | 0.0049 |
| IGT | 593 | 13.8% | 0.8% | 334 | 14.6% | 1.1% | 66 | 7.3% | 0.8% | 168 | 14.8% | 1.3% | 0.0003 |
| IFG or IGT§ | 1318 | 32.0% | 1.1% | 705 | 33.0% | 1.4% | 183 | 21.8% | 1.3% | 368 | 33.8% | 2.1% | 0.0009 |
| IGH | 939 | 18.7% | 0.7% | 434 | 17.7% | 1.1% | 250 | 29.8% | 1.9% | 228 | 17.0% | 1.5% | <.0001 |
| IGH only** | 493 | 9.3% | 0.5% | 220 | 8.7% | 0.7% | 158 | 18.8% | 1.4% | 110 | 7.2% | 0.9% | <.0001 |

*
UnW n= Unweighted n

†
% are weighted.

‡
Any prediabetes is defined as meeting diagnostic criteria with FPG, OGTT, or A1c (excluding those with self-reported diabetes).

§
Indicates those who would meet diagnostic criteria for prediabetes before 2010 A1c diagnostic guidelines were issued.

**
IGH only includes only those who meet diagnostic criteria of prediabetes with the new A1c method. Those who meet diagnostic criteria under IFG or IGT are excluded, as are those who are diabetic. This represents the individuals who are only indicated to be at risk for diabetes under the new A1c criteria.

**Table 2**

Odds ratios predicting prediabetes by race/ethnicity[*] by classification from NHANES 2005–2008 in fully adjusted[†] model.

|  | Any Prediabetes (IGT, IFG, or IGH) | IGT | IFG | Pre-2010 Definition of Prediabetes (IGT or IFG) | IGH | "IGH-Only"[†][‡] |
|---|---|---|---|---|---|---|
|  | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) | OR (95% CI) |
| Non-Hispanic Black | 0.89 (0.62–1.28) | 0.35 (0.24–0.50) | 0.46 (0.30–0.73) | 0.43 (0.29–0.65) | 2.22 (1.33–3.70) | 3.47 (1.96–6.16) |
| Mexican American/Other Hispanic | 0.99 (0.71–1.40) | 1.18 (0.79–1.75) | 0.87 (0.60–1.26) | 1.01 (0.72–1.42) | 1.17 (0.82–1.66) | 1.08 (0.68–1.73) |

[*] Non-Hispanic White is reference group.

[†] Adjusted for gender, weight, age, education, and poverty.

[‡] Prediabetes only under IGH. This final group would only have been classified as "at risk" using the new A1c diagnostic criterion.